Responding to the Emergency Mobile Locations Call for Inputs

Creativity Software Ltd

	OFCOM QUESTION	Response
Question 1.1	Is Ofcom correct in focusing its attention on ECLI for mobile emergency calls (as opposed, for example, to fixed-line or VoIP calls) at this time?	Yes. 67% of calls to 999/112 are initiated from mobile devices, and this proportion is forecast to increase. This correlates with the proportion of the UK population who own a mobile phone. (Penetration rates of 150% notwithstanding). Fixed line call accuracy is not a problem. VOIP calls are a minor fraction of calls at this time. There are enormous vested commercial interests (the mobile network operators) in this proportion remaining small. Therefore, ECLI calls from mobile form the bulk of the problem today and are forecast to continue to be the bulk of the problem for the foreseeable future. Whilst a solution for VOIP may become necessary in due course, it does not diminish the need to solve the mobile problem at this time. For example, around 330,000 calls are made each year to the emergency services in which a response may be needed, yet the caller is unable to speak. More accurate location data can assist in these cases. This is a discrete problem that is able to be solved today with standards based, reliable, cost effective technology solutions. Unless the problem is addressed, it will continue to contribute to avoidable death and unnecessary suffering (medical), damage (fire) and crime (police). These costs far exceed the cost of the solution.
Question 1.2:	Are there, in your view, any concerns associated with the current provision of mobile ECLI in terms of a)	Yes a) Accuracy. In terms of the problem of poor levels of accuracy, the observations in the

	accuracy and b) reliability? If so, what are these concerns	Ofcom document are well made. Whilst there is no specific measure of the level of accuracy required, a quantifiable assessment of service delivery against this important criterion is impossible to assess. Nonetheless, what is beyond doubt is that cell-id is inadequate. Enhanced cell-id is a straight forward technology update that enables quantifiable improvements in accuracy. b) Reliability. Low levels of reliability could reflect the evolution of network technology over the past 10 years. 10 years ago, most mobile networks had a single radio network vendor - for example Ericsson or NSN. The networks were almost entirely 2G. Over time, other radio network equipment - from Huawei for example - has been deployed alongside the original network equipment - both to extend and improve coverage, and also to introduce 3G and 4G based services. Location platforms (GMLC) deployed 10 years ago would need to have been updated to accommodate these changes. If they have not, then this could explain some of the reliability issues. For example, unless the message flow handlers have been updated, the location platform would not be able to decode the data to identify the location of a 3G based caller.

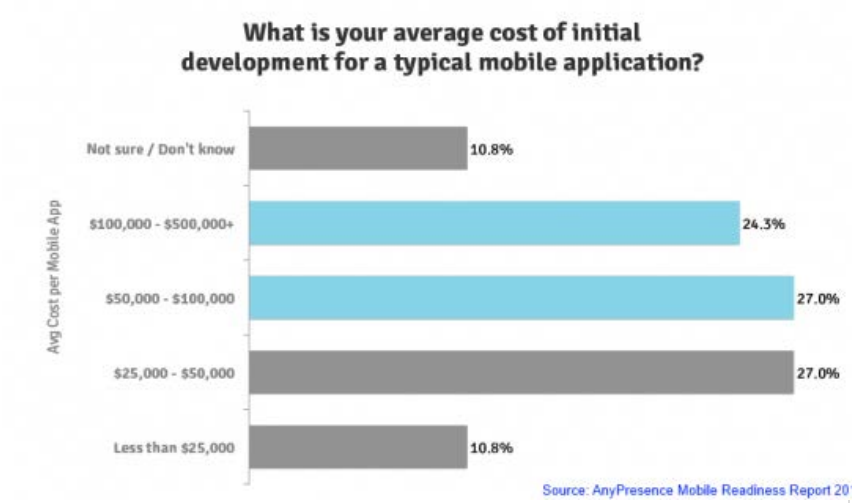
Question 2:	Do you agree that network-based approaches could offer solution to tackle the potential issues regarding reliability and accuracy of mobile ECLI?	Yes. Both reliability and accuracy of location data can be improved using network based solutions. ACCURACY Network based solutions address the needs of emergency and security requirements in a great number of countries today. There are many examples where accuracy and reliability are clearly specified requirements - e.g. the USA, Australia & Japan, as well as less developed economies. In many countries location platforms are in place for law enforcement purposes, and these have higher levels of accuracy than cell-id, and they all depend upon the same network based solutions. These countries cannot be named in a publicly facing document but can be evidenced separately. There are several technology vendors that have delivered these solutions, and each will be able to evidence the level of accuracy and reliability that they have contracted to deliver. For example, Creativity Software is a UK based company that has deployed network based solutions delivering accurate and reliable location data in Middle East, Africa and Europe. For example, Ericsson have over 120 deployments worldwide, and publish the accuracy that they commit to delivering. RELIABILITY Reliability can be defined in various terms and measured accordingly. It is standard practice for technology vendors to be provide hardware, software and services against a Service Level Agreement (SLA). All location platform vendors are bound by these in every deployment worldwide. It would be relatively straight forward to adopt the same approach for the delivery of service by the CPs to EAs. 1) %ge of uptime availability of the service can be determined - and is a standard criterion by which technology is monitored by mobile networks. The standard uptime target is 99.999% 2) time taken to process an end to end location request can be determined and monitored. This is also a standard means by which technology is monitored by mobile networks. As an example,

		the average time taken for a location request using standard push methods is within a second. 3) reliability of the reference data that provides the physical location of cell towers is an important element necessary for all network based location solutions. This can also be measured - with an initial audit and then sampling over time. There are changes made to the database of cell tower information on a daily basis. There are tools (for example from Creativity Software) that automatically ingest and process (and report on discrepancies) as the database is updated. Accuracy is able to be determined and measured, and is covered in a later answer. In short, ECID provides measurable improvements in terms of accuracy over cellid.

Question3:	To what extent would the provision of such solutions be reliant on the deployment of LTE networks and what would be the likely timescales for implementing such solutions?	There is no requirement whatsoever for the deployment of LTE networks in order to improve the accuracy and reliability of mobile location determination. It is possible - and very straight forward - to increase the accuracy and reliability for existing 2G and 3G networks, by adopting the 3GPP standards for ECID (Enhanced cellid). 3GPP standards also cover LTE. The foremost consideration of 3GPP standards is to ensure forward and backward compatibility, to ensure uninterrupted service to handsets as mobile network technologies evolve. This means that the solution put in place for 2G & 3G network elements will (a) today cover LTE and (b) can be upgraded over time to accommodate changes in the way LTE networks support voice calls AS LONG AS THE LATEST 3GPP STANDARDS ARE OBSERVED. In summary: LTE is not a requirement for increased accuracy or reliability. LTE can be accommodated alongside 2G and 3G requiremnts with the same network technology (GMLC and SMLC) as long as the latest 3GPP standards are observed.
Question 4:	Could these solutions offer the same benefits to Limited Service State ('LSS') callers and internationally registered callers as for domestic end-users using their 'home' network?	Yes. LSS callers and inbound international roamers can be located with the same degree of accuracy as domestic end users. 3GPP standards cover this requirement. Specifically, 3GPP TS 23.271 describes the procedures and interface (Lr) to handle emergency and roaming locate requests similar to normal location request.

Question 5.1:	Do you think that handset based approaches (e.g. Apps) could offer a cost-effective and dependable means to tackle potential problems linked to accuracy and/or reliability in mobile location information? If so, what are the likely costs to all parties involved in the end to end support of handset-based approaches?	No. Handset based approaches are neither cost-effective nor dependable when the requirement is a universal coverage for emergency service provision. For the reasons laid out in the Ofcom document, solutions that depend upon or employ functionality residing on the handset can help address the issue of accuracy, but are not reliable. It should also be noted that - despite the increasing proportion of smart phones - legacy/dumb devices which cannot run apps, will continue to exist in the market. In 2017, 10 million people in the UK (19% of mobile users) will not have access to an app based smart phone. (eMarketer, June 2013) The problem is greatest amongst older people - who are disproportionately greater users of emergency medical/ambulance services. Among adults, smartphone usage decreases with age. In 2013, 62.3% of mobile phone users ages 45 to 54 and 37% of those ages 55 to 64 will own and use a smartphone, but only 13% of mobile phone users 65 and older. (eMarketer, June 2013) Meanwhile, patients aged 65 years and over account for 18% of all attendances at Accident & Emergency. (Public Health and Epidemiology, University of Birmingham). USA research shows that use of ambulance services by the over 65's is 30% of all calls. In The Medical Journal of Australia, a 2011 study showed that the number of emergency/ambulance transportations will increase by 46%–69% from 2007–2015, disproportionately driven by increasing usage by patients aged ≥ 85 years. So an app solution may work for the younger population but will not provide a service for the ageing population in the UK. The costs of end to end support of Apps can be broken down into 4 sections: 1. Design 2. Development 3. Test 4. Awareness DESIGN, DEVELOPMENT & TEST A 2013 Research Report shows the average development cost of an app aimed at smart phones to be between £30-£65K - mid-point of £50K.

Figure 1 Cost of enterprise mobile app development



This cost is for a single "platform" or mobile operating system. 6 major operating systems (IOS, Symbian, Android, RIM, Linux & Windows) account for 99% of the market. Each platform has variants - currently 4 on the recently launched Apple iphone 5S alone (after 6 weeks in the market). At launch of the app, each handset that is in market needs to be tested and a separate build deployed for each variant as necessary. Then, each new handset launched to market needs to be tested, with a new build as necessary. Then with each new operating system version release a full test cycle will be required for each handset in market. According to MGI Research, most mobile apps will experience at least four major update cycles stemming from operating system and device updates in the 2012-2014 time frame. Forrester Research estimated that the initial cost of an app would equate to 35% of the 2 year life cycle costs.

Dr Tim King, chief technology officer of app toolkit vendor 5app estimates that if a single application platform development cost £50,000, the cost for a 6 platform application would be £150,000. If this is 35% of the 2 year costs, then the 2 year cost would equate to £428,000. Allow for a doubling over 5 years, and this takes the design, development and support costs to £856,000 for a commercial application. Any app on which emergency service support was dependent could be expected to exposed to greater test scrutiny and, consequently, higher costs.

AWARENESS

Unless the handset manufacturers can be obligated to pre-load the application, it will be necessary for the application to be distributed. If the distribution requires any end user interaction then there will need to be an awareness campaign to communicate and encourage the desired behaviours. Whilst the handset itself provides a medium for communication, it cannot be

		relied upon as long as universal take up is the end goal. To help assess the costs of awareness campaigns there are some recent health/community service precedents. In 2011 a £4.5mn campaign was run to highlight the symptoms and dangers of bowel cancer, and the Change4Life campaign cost the government £75mn over 3 years in an attempt to encourage better eating and more exercise.[Health Service Journal 24-11-11] Change4Life attempted to reach out to the entire UK population, in much the same way that a 112 application would require. Whatever the campaign specification, it seems unlikely that costs could be lower than £20mn over a 5 year cycle. TOTAL BUDGET Over 5 years it would seem that the budget for an app is unlikely to be less than £20mn. And this for a solution that does not satisfy the need for reliability/dependability in all conditions (indoors, urban canyoning, end user disablement etc) and will not be able to be used by 10 million, mostly older people in the UK. Having said that, employing data available on the device in some way can contribute to the solution as an supplementary data source. Handset dependency does not necessarily rely upon a distributed app, but can be addressed by network features - such as A-GPS.

<table>
<tr><td>Question 5.2:</td><td>Do you see solutions such as Apps as a long-term alternative to network-based approaches?</td><td>For the reasons stated above and in the Ofcom report, it is unlikely that an app based solution could replace network-based approaches in the foreseeable future (5-7 years).

App based or handset dependent solutions may contribute to improvements in location accuracy, and can be seen as being complementary to network based approaches.

Although it is outside the scope of this report, it should also be highlighted that the needs of UK police and intelligence services are also catered to by the network-based solutions. Handset dependent solutions - for the reasons above but in particular the ability of end users to disable/tamper with the solution - do not satisfy the needs of law enforcement.</td></tr>
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<tr><td>Question 6:</td><td>What are the changes that EAs would suggest in order to address potential issues regarding accuracy and reliability of mobile ECLI?</td><td>ACCURACY

At present there is no definition of accuracy requirements.

Setting specific accuracy tables would enable (a) an increase in the accuracy of data available to assist with emergency service provision and (b) the setting of contractual SLAs against which service providers and their technology vendors would be measured.

A definition with broad parameters would be better than the current situation, where there is no measurement. A table of accuracy per environment (urban, suburban, rural) might be used, such as that shown below.

<table>
<tr><td>Environment</td><td>67% Error</td><td>95%Error</td></tr>
<tr><td>Urban</td><td>350m</td><td>750m</td></tr>
<tr><td>Suburban</td><td>500m</td><td>1200m</td></tr>
<tr><td>Rural</td><td>3000m</td><td>6000m</td></tr>
</table>

It should be noted that the environment definitions reflect average clutter types as per the below:

Urban: <500metres

Suburban 500m-1500m

Rural 1500m-20km</td></tr>
</table>

		RELIABILITY The contracts that mobile network operators sign with vendors demand 99.9997% availability for any hardware/software on which there is a dependency within the mobile network. It would seem reasonable that this level form the basis of the reliability measure for location data. *NB In some countries - for example the USA - there are very specific definitions of location accuracy which are well known to Ofcom. The FCC 911 table could be adopted, which would bring the UK to international levels of best practice.* *These levels of accuracy are achievable with software solutions - and these solutions are available from companies such as Creativity Software in the UK, Ericsson in Sweden and one or two other vendors. The implementation costs for this type of the solution are likely to be £2-3mn for each mobile operator.* *Given the economic backdrop, and the absence of specific legislation requiring this level of accuracy, we recommend adopting a more pragmatic approach - as per the above table - for which the cost is lower.*
Question 7:	What would be the potential costs implications for EAs if such changes were to be implemented?	The accuracies stated in the table in the previous section are able to be achieved through the use of standard, 3GPP defined software nodes,. These are GMLC & SMLC, which together enable Enhanced Cell-id (ECID). GMLC nodes exist in each of the UK mobile networks - albeit that they may not be fully compliant with current 3GPP requirements, and may need updating or replacing. GMLC and SMLC software nodes are available from a number of vendors - including Creativity Software from the UK, Ericsson from Sweden, TCS from the USA. The costs would be approximately as shown below, with an upper and lower range, based on known pricing of these solutions in the market. The table shows two options:

		(a) a centralised option whereby one set of hardware is deployed with the GMLC & SMLC nodes connected via IP links to each of the 3 mobile networks; and (b) a distributed option, whereby each of the operators deploys hardware and software in their own network.

Estimated Costs		**Low** £'000	**High** £'000
1 Single platform covering 3 MNOs	a.Initial license + deployment cost	700	1,400
	b.Annual costs	275	550
	Total 5 Year cost	2,075	4,150
	Total 5 year cost per MNO	**692**	**1,383**
Platform per MNO	Initial license + deployment cost	550	1,100
	Annual costs	250	500
	Total 5 year cost per MNO	**1,800**	**3,600**

Question 8:	Are there ways in which tackling potential issues regarding the accuracy and/or reliability of mobile call ECLI could adversely affect consumers, and could these be mitigated?	Consumers will benefit from the improved emergency service levels that are able to be delivered as a consequence of improved location accuracy and reliability. There are no adverse impacts whatsoever for consumers. Mobile operators' key performance measures (specifically with regard to quality of service) should be unaffected by these improvements. Bear in mind that the GMLC node exists in all networks today, and all that is required is an additional software node (SMLC) that complies with 3GPP standards. So, even as emergency calls are received and processed with greater accuracy, there should be no impact on non-emergency calls in terms of quality of service.

Question 9:	If Ofcom was to consider setting further criteria for the accuracy and reliability of ECLI, should these be independent of the technology used by a CP?	Yes. There is no need for Ofcom to determine the technologies. It would appear sensible and logical to adopt the standards that are defined by 3GPP, which themselves determine the operational parameters within which the CPs operate the mobile networks. The major focus for 3GPP is to provide for backwards and forwards compatibility, to ensure that the operation of user equipment (handsets) is uninterrupted. By leaning on 3GPP, it is possible for Ofcom to avoid having to specify the technology to be used. This avoids being caught in discussions on best technology for location determination, and avoids getting caught in (misleading) debates about 2G/3G/4G compatibility. The major focus for all 3GPP Releases is to make the systems (employed by the mobile network) backwards and forwards compatible wherever possible, to ensure that the operation of user equipment is uninterrupted. A good current example of this principle has been the priority placed in the working groups on backward compatibility between LTE and LTE-Advanced, so that an LTE-A terminal can work in an LTE cell and an LTE terminal works in the LTE-A cell. In defining how handset location is determined in a mobile network, 3GPP does not define the technology per se, but more the data parameters that can be extracted from the mobile network to enable enhanced accuracy calculations. Cellid (CID) - as noted in the Ofcom report - is defined as the coordinates of the cell that is serving the handset, plus the power range/radius of that cell. Enhanced Cellid (ECID) provides for greater accuracy from network data. This is defined in the 3GPP standards (as below) as additional measurements/parameters which are available from the mobile network, which can be used to calculate location with more precision than cellid alone (hence “enhanced” cellid). In other words, by specifying the data parameters that can be collected, there is no need to specify the technology, as shown below in the quote from the relevant 3GPP documentation:

		[From 3GPP TS 25.305 V10.0.0 (2010-09)] "Enhanced Cell ID Methods: Techniques which use additional UE and/or UTRAN radio resource related measurements are defined under Enhanced Cell ID. Measurements for these ECID methods may include: UE measurements: - UE Rx-Tx Time Difference (FDD); - pathloss; - CPICH RSCP (FDD); - CPICH Ec/No (FDD); - Timing Advance (TDD). UTRAN measurements: - RTT (FDD); - Rx Timing Deviation (TDD); - Angle of Arrival (1.28 Mcps TDD). Various techniques exist to use these measurements to estimate the location of the target [handset]. The specific techniques are beyond the scope of this specification." In summary, if the parameters are collected then the processed results would be expected to be more accurate as a consequence. The improvement in accuracy will be determined by the amount of data (number of neighbouring cells for example) and the clutter type (femtocells…..macrocells).